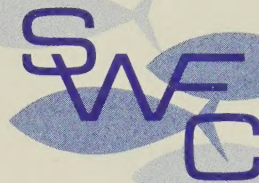




HONOLULU
LA JOLLA
MONTEREY
TIBURON



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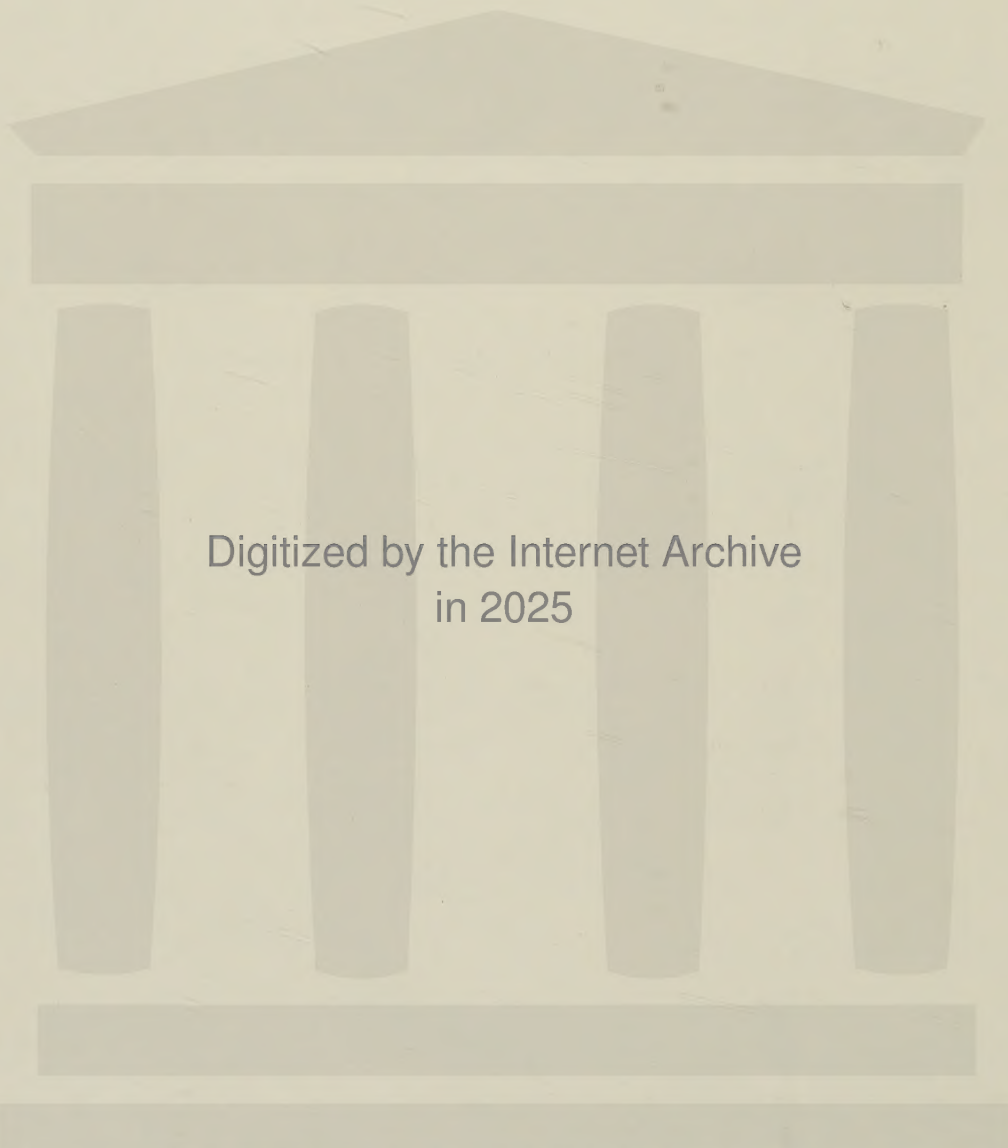
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SOUTHWEST FISHERIES CENTER

MONTHLY REPORT - OCTOBER 1977

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LA JOLLA, CALIFORNIA

HONOLULU LABORATORY
LA JOLLA LABORATORY
TIBURON LABORATORY
PACIFIC ENVIRONMENTAL GROUP

MONTHLY REPORT - OCTOBER 1977

STATUS OF PUBLICATIONS

Published

Arthur, David K. 1977. Distribution, size, and abundance of micro-copepods in the California Current system and their possible influence on survival of marine teleost larvae. Fishery Bulletin, U.S. 75(3): 601-611.

The California Current system can be divided into onshore and offshore faunal zones by a copepod indicator species, Mecynocera clausii. Near the outer edge of the onshore zone copepod nauplii densities were higher than usual. There were about 3 times as many microcopepodids and 12 times as many nauplii on the average throughout the onshore as in the offshore zone. Feeding habits of larvae of sardines, anchovies, and jack mackerel may be adapted to the usual naupliar and copepodid concentrations of the zone in which they were spawned. The usual concentrations of 56- μ m and wider nauplii in the onshore zone was about 3/liter with 17/liter the highest observed which indicates that for nauplii of all sizes there were usually about 36/liter and with the highest density of 195/liter. These concentrations are lower than has usually been reported to be required for rearing larval fish in laboratories. Numbers of nauplii decreased exponentially with increasing size but a naupliar biomass maximum was found to occur at about the 70 μ m width. Nauplii of this size are ingested at first feeding by Pacific sardine, northern anchovy, and jack mackerel larvae. It is suggested that larval feeding habits of these fish have evolved to utilize this important food resource at their first feeding.

This report does not constitute publication and is for information only.

Eldridge, Maxwell B., Tina Echeverria, and Jeannette A. Whipple. 1977. Energetics of Pacific herring (Clupea harengus pallasi) embryos and larvae exposed to low concentrations of benzene, a monoaromatic component of crude oil. Trans. American Fisheries Society, 106(5): 452-461.

Interest in the energetic processes of critical early life stages of Pacific herring (Clupea harengus pallasi) and the potential effects from sublethal exposure to benzene, a monoaromatic component of crude oil, led to a series of experiments which examined metabolism of herring embryos, yolk-sac larvae, and post-yolk-sac larvae. Yolk caloric content was 6,020 cal/g or 1.3 calories per egg. This energy was consumed rapidly during incubation; total yolk absorption occurred 12 days after fertilization. Anabolic rates varied but at no time was there an energy deficit. Oxygen consumption of embryos increased prior to hatching, then a 10-fold rise was seen in newly hatched yolk-sac larvae. Exogenous calories were estimated from ingested rotifers and were less definable than endogenous energy due to variable grazing rates. Sublethal concentrations of benzene caused (a) significantly less embryonic tissue growth, (b) significantly different oxygen consumption in embryos, and (c) significantly greater assimilation in feeding larvae. It is believed activity of larvae played an important role in accounting for increased metabolism of later stages.

Perrin, William F., Ruth B. Miller, and Priscilla A. Sloan. 1977. Reproductive parameters of the offshore spotted dolphin, a geographical form of Stenella attenuata, in the eastern tropical Pacific, 1973-75. Fishery Bulletin, U.S. 75(3): 629-633.

Scura, Edward D. and Charles W. Jerde. 1977. Various species of phytoplankton as food for larval northern anchovy, Engraulis mordax, and relative nutritional value of the dinoflagellates Gymnodinium splendens and Gonyaulax polyedra. Fishery Bulletin, U.S. 75(3): 577-583.

First feeding northern anchovy larvae were presented with a variety of phytoplankton common to coastal waters of southern California to determine which species are acceptable as food. Most of the larvae ate the four species of dinoflagellates tested in feeding experiments but did not feed on diatoms or small flagellates. Larval rearing experiments were conducted to compare the nutritional value of Gymnodinium splendens and Gonyaulax polyedra, two species of dinoflagellates readily eaten by anchovy larvae and known to predominate in the chlorophyll maximum layers off the southern California coast. Gymnodinium splendens was a nutritional food for the first 10 days of larval life, but Gonyaulax polyedra was

judged to be inadequate. Supplementing the G. polyedra diet with microzooplankton increased larval survival comparable to survival on a microzooplankton diet alone. When the Gymnodinium splendens diet was supplemented with microzooplankton, the larvae grew faster but survival did not increase. Results are discussed in relation to studies on larval survival in the Southern California Bight during 1974 and 1975.

Approved by Center Director

Saur, J.F.T., L.E. Eber, D. R. McLain, and C.E. Dorman. Vertical sections of mean temperature on the San Francisco-Honolulu route: from expendable bathythermograph observations, June 1966-December 1974. For publication in NOAA Technical Report, SSRF.

Greenblatt, Paul R. Associations of tuna with flotsam: an examination of fishery data for the eastern tropical Pacific. For publication in the Fishery Bulletin, U.S.

Moffatt, Nancy M. and Donald A. Thomson. Tidal influence on the evolution of egg size in the grunions (Leuresthes). For publication in Environmental Biology of Fishes.

Moffatt, Nancy M. and Donald A. Thomson. Reciprocal hybridization between the California and Gulf of California grunion, Leuresthes tenuis, and Leuresthes sardina (Atherinidae). Fishery Bulletin, U.S.

HONOLULU LABORATORY

RESOURCE ASSESSMENT AND DEVELOPMENT INVESTIGATIONS (RADI)

Tagged Yellowfin Tuna Recaptured

Mr. Tamio Otsu, Chief, RADI at the Honolulu Laboratory, reported that word was received from Japan on the recovery of a tagged yellowfin tuna, Thunnus albacares. A Japanese baitboat, No. 11 Taiyo Maru based in Mie Prefecture, reported the capture of the tagged fish, which weighed approximately 7 kg, on August 28, 1977 at lat. 27°40'N, long. 175°30'W. The fish had been tagged on Townsend Cromwell cruise 77-02 on July 22, 1977 near Pearl and Hermes Reef at lat. 27°59'N, long. 175°58'W. Thus, the yellowfin tuna was recaptured after being at liberty only a little over a month, approximately 31 nautical miles away (straight line distance) from where it was first captured and tagged. Dr. Robert Skillman was Chief Scientist on Townsend Cromwell cruise 77-02.

Mt. Otsu noted that the No. 11 Taiyo Maru could possibly be the same pole-and-line vessel that was featured in the Japanese fishing film "Toward Tomorrow's Seas." The film was recently acquired by the Honolulu Laboratory and was shown at the Open House on October 16.

Western Pacific Regional Fishery Management
Council (WPRFMC) Adopts Spiny Lobster
Management Plan

Dr. Jerry Wetherall, Leader of the Fishery Management Research Task at the Honolulu Laboratory, reported that the WPRFMC adopted the draft Fishery Management Plan for spiny lobsters in the Northwestern Hawaiian Islands (NWHI) at its September meeting held on Maui. Task researchers Dr. Michael Adams, Industry Economist; Dr. Roy Mendelssohn, Operations Research Analyst, and Mr. Howard Yoshida, Fishery Biologist, as members of the Spiny Lobster Planning Team, made important contributions to the draft plans. Dr. Tim Smith, University of Hawaii, Chairman of the Planning Team, Dr. Adams and Dr. Mendelssohn attended the meeting to present details of the proposed management plans.

The Council reviewed the draft plans and acted on the management measures recommended by the Scientific and Statistical Committee (SSC) including: (1) prohibition on lobster fishing inside the 10-fathom isobath; (2) Laysan Island lobster refuge; (3) restriction of gear types and fishing methods; (4) permits, observers, and logbooks; (5) inspection of catches; (6) minimum sizes; (7) prohibition on retention of berried lobsters; and (8) annual review.

Dr. Mendelssohn is presently editing and reworking the plan to include the management measures adopted by the Council. A finished document ready for public hearings is expected to be ready in a month.

Plans Being Finalized for Cooperative
Studies in the NWHI

Dr. Robert Skillman, Coordinator, NWHI Study at the Honolulu Laboratory, announced that a variety of studies are being planned or proposed for the NWHI area. Dr. Richard Grigg, UH Sea Grant Program, has been awarded Sea Grant funds to carry out research on precious coral in the NWHI as well as in the main Hawaiian Islands. In conjunction with this grant, Mr. Mike Palmgren, UH graduate student, will be participating in Cromwell cruise 77-03 (Part I) to do some preliminary coral dragging in the NWHI. Dr. Grigg will be participating in Part II of the same cruise.

Dr. Grigg is now working with the Honolulu Laboratory in setting up a Sea Grant research package that will complement the research being done currently by the three agencies formally involved in the cooperative study of the NWHI. Formal research proposals will be submitted to Sea Grant on the following: water column primary and secondary productivity

(J. Hirota); reef primary productivity (D. Kinzie); community ecology of reef and shelf corals (R. Grigg and S. Dollar); population ecology of lobsters (T. Smith and C. MacDonald); population ecology of shrimp (K. Gopalakrishnan); fishery biology of snappers and groupers (S. Ralston); trophic dynamics of sharks and other primary carnivores (L. Taylor); population ecology of green turtles (G. Balaza); population genetics of commercial species (J. Shaklee); and socio-economic and legal impacts (J. Rutka). Messrs. Ralston, Rutka, Shaklee and Gopalakrishnan have visited the Honolulu Laboratory seeking background information to develop their proposals. The proposals are to be submitted in early December.

In the interest of keeping the formal cooperative study on its charted course and to integrate the research proposals from Sea Grant into the program, a workshop has been tentatively scheduled for November 22, 1977 at the East-West Center, University of Hawaii, Manoa Campus. After reviewing the ongoing research and the proposed research, the participants will address such questions as: are the objectives of the study being met; what research topics are missing; and how will all the pieces be tied together?

* * * * *

To understand more fully the function of data base management systems, Dr. Skillman attended the comparative Data Base Management Systems National Conference for one week in Los Angeles. The knowledge gained will be applied to the Honolulu Laboratory's input into the Fishery Information System for fisheries data relative to the Fishery Conservation and Management Act of 1976, the management information system for the Southwest Fisheries Center (SWFC), and the NWHI information system.

The Advisory Committee for the establishment of the Fishery Information System held its first formal meeting in San Francisco in October. Participants included representatives from SWFC (Messrs. Dave Mackett, Fred Kellenberger, and Dr. Skillman), Southwest Region, California Fish and Game, and the contractor, Potomac Research, Inc. Discussions centered around the content of the fishery information system issue paper that is to be prepared by Potomac Research, Inc.

Arrangements are being made to have a systems analyst/programmer from Potomac Research, Inc., through GSA, design a data base management system for the Honolulu Laboratory's NWHI data. The contractor will be at the Laboratory in early January to start work on the system.

Dr. Skillman also participated in a demonstration of the NBI word processing equipment and in discussions on Honolulu Laboratory's use of this equipment as the communication system for the SWFC management

information system. A management information system, which will include financial and other management information, is now under study by the SWFC.

* * * * *

Mr. Thomas Hida, Acting Leader, Insular Resources Task, completed a preliminary draft of cruise plans for Townsend Cromwell Cruise 78-01 Part II. He also worked with Mr. Augie Barcott of the Northwest and Alaska Fisheries Center in readying a northeastern trawl for the cruise.

Other members of the Task worked on processing data and material collected on cruises to the NWHI. Research Assistants Martina Queenth and Robert Moffitt processed otolith samples for age and growth studies.

Task Leader Richard Uchida, Fishery Biologist James Uchiyama, and Research Assistants Glenn Higashi, Robert Humphreys, and Darryl Tagami are on board the Townsend Cromwell (Cruise 77-03).

Estimated 1977 Hawaii Landings of Skipjack Tuna Continue Below Long-Term Average

The September 26 to October 23 Hawaii landings of skipjack tuna were estimated at 178.8 metric tons (MT), which is 86 MT below the landings for the same period in 1976 and 95.1 MT below the 1948-76 long-term average for the same period. The cumulative landings from January through October 23 were estimated at 3,181.2 MT, which is 545.3 MT below last year's landings for the same period and 794.6 MT below the 1948-76 long-term average for the same period.

* * * * *

Pulou Niutoa, employee of the Government of American Samoa, measured 1,050 albacore from 21 vessels during the period from August 16 to September 9. He also collected 35 sets of catch and effort data. Utilizing data from 5 vessels, the average size of albacore for the period was 89.8 cm and the catch rate averaged 2.1 albacore per 100 hooks.

FISH-ENVIRONMENT INVESTIGATIONS (FEI)

Thermoregulation Experiments to be Computerized

Dr. Andrew Dizon, Leader, Experimental Ecology of Tunas Task at the Honolulu Laboratory, reported that the HP 9825 computer arrived during the first week of the month and was immediately placed in operation to provide output displays of telemetry information for the

Open House. Its initial job, however, will be to control and process information from the current yellowfin tuna thermoregulation experiments. Towards this goal, an interface was constructed so that information could be transmitted from the control module of the behavioral thermoregulation tank ("doughnut tank") to the computer. The HP 9825 already has an interface system (HP-IB) that allows information to be transmitted from the frequency counter (body temperatures) and the digital volt/ohmmeter (sea water temperatures). The computer also controls the temperature of the sea water.

To date, the computer has been used to control two 3-day experimental series and has been an exceptional performer. The data are archived in real temperature and velocity units and also include 10 minute means and standard deviations. The data rate of over three blocks per minute, while not high by modern standards, is still tremendous in savings in man-hours over hand analysis.

Report on the Nineteenth Hawaiian International Billfish Tournament Completed

Mr. Heeny Yuen, Leader, Recreational Fisheries Task, completed a report describing the results of the Nineteenth Hawaiian International Billfish Tournament. Briefly, the qualifying catch of the tournament consisted of 71 blue marlin, Makaira nigricans; 14 yellowfin tuna; 1 striped marlin, Tetrapturus audax; and 1 shortbill spearfish, Tetrapturus angustirostris. The blue marlin ranged from 60.3 to 309.8 kg and averaged 105 kg. The yellowfin tuna ranged from 49 to 101.4 kg and averaged 80.6 kg. The striped marlin weighed 46.5 kg and the shortbill spearfish 3.2 kg.

The stomachs of the blue marlin contained representatives of 15 different fish families. As usual the tunas were the most important item in the diet of the blue marlin. They occurred in 69% of the stomachs examined.

LA JOLLA LABORATORY

Coastal Fisheries Resources Division

ALBACORE FISHERIES PROGRAM

Report in Preparation on NMFS/AFRF Cooperative Albacore Research Studies in 1977

Dr. Michael Laurs reports that he and his staff in the Albacore Fisheries Program at the La Jolla Laboratory began preparation of a report on the NMFS-American Fishermen's Research Foundation/AFRF

cooperative albacore research studies carried out during 1977. The studies include exploratory fishing/research operations conducted by two U.S. jigboats on charter to AFRF and the Pacific Tuna Development Foundation in the western North Pacific. Mr. James Bryant, student intern from San Diego State University, under the direction of Robert Nishimoto, Fishery Biologist at the La Jolla Laboratory, is processing albacore catch and effort data and XBT observations made by the two vessels. Mr. Nishimoto is also processing tag release and recovery data resulting from the joint NMFS-AFRF tagging program. He reports that 1,796 albacore were tagged and released during the 1977 fishing seasons by boats on charter to AFRF. Of this total, 700 albacore were tagged with special red tags under the direction of Ron Dotson, Biological Technician on board the fishing vessel, Linda, on charter to AFRF and injected with tetracycline to "mark" otoliths at times of release for albacore growth studies. Thus far 10 tetracycline-injected fish have been recovered after being at liberty from 1 to 61 days, and turned over to scientists at the La Jolla Laboratory.

Mr. Nishimoto continued processing catch and effort information from the three jigboats on charter to AFRF that carried out albacore scouting/research operations during the 1977 albacore fishing season. These boats, which completed charter operations in late September, conducted fish scouting, kept detailed fishing logs, tagged fish, and made oceanographic observations, including expendable bathythermograph drops.

* * * * *

Dr. Laurs reports that arrangements were completed in October for the services of four albacore jigboats on charter to AFRF who will also work cooperatively with the La Jolla Laboratory during a 30-day study in November to investigate the "southern" group of fish that comprise the U.S. albacore fishery. On October 31, Dr. Laurs and Mr. Nishimoto met with the captains and crews of the four vessels to brief them on making fishery and oceanographic observations and provided training in fish tagging. Mr. Mark Sweeney, Electronic Technician with the Oceanic Resources Division at the La Jolla Laboratory, provided training in the operation of radio facsimile recording equipment. In addition, Mr. Forrest Miller of the Inter-American Tropical Tuna Commission, presented a briefing on weather and sea conditions that may be expected during the charter period and on interpretation of radio facsimile weather charts.

1977 Albacore Fishing Season One of Poorest since 1951

The 1977 albacore fishing season on the Pacific coast has been one of the poorest in many years according to Dr. Michael Laurs, Leader of the Albacore Fisheries Program at the La Jolla Laboratory. Landings

for the season are projected to be approximately 25 million pounds which is about one-half the 10-year average and the lowest since 1951. Albacore fishermen have been plagued by a lack of fish in the Pacific Northwest; inconsistent, scattered catches along the rest of the coast; fish that won't "bite," notably off California and northern Baja California; and high winds and rough seas on many days, especially off northern and central California.

Dr. Laurs believes that the scarcity of fish in the Pacific Northwest was due to a late migration of albacore from the western Pacific. Based on findings resulting from the National Marine Fisheries Service-American Fishermen's Research Foundation cooperative albacore studies it appears that a major portion of the fish which enter the U.S. albacore fishery in Pacific Northwest waters make trans-Pacific migrations back and forth between the eastern and western Pacific, and that these fish are a separate group from those which enter the fishery off California south of about San Francisco. The latter group do not appear to migrate to and from the western Pacific. Fishery results from the Japanese pole and line albacore fishery and from two U.S. jigboats operating in the western Pacific during May to August indicate that in 1977 albacore were late in their emigration from the western North Pacific. Dr. Laurs further speculates that the inconsistent and scattered catches of albacore which have occurred along much of the west coast may be related to the failure of albacore forage organisms to concentrate as the result of weak coastal upwelling. Coastal upwelling indices produced at the Center's Pacific Environmental Group in Monterey show that upwelling was anomalously low along much of the Pacific coast of the U.S. during much of the albacore fishing season. When coastal upwelling is more pronounced, which is usually the case during the summer months, a relatively strong "ocean front" or gradient between cool, upwelled waters and warmer, non-upwelled water is formed. High biological productivity is associated with the upwelling front and albacore forage organisms are found concentrated there.

Research by Dr. Laurs and his associates at the La Jolla Laboratory has shown that albacore remain in the vicinity of upwelling fronts (presumably feeding) while an upwelling front is well-developed, but move away from the area where the front was located when the front breaks down. Examination of albacore catch records also show that fishing success is highest in the vicinity of upwelling fronts.

Virtually nothing is known about why albacore do not "bite." However, many albacore fishermen complained during the 1977 fishing season that they sighted schools of albacore at the surface or at depth on sonar, and that simultaneously fishing conditions have been good, but that the fish would not bite. This problem has been especially prevalent off central and southern California and off northern Baja California.

Inclement weather conditions apparently have markedly affected fishing effort off northern and central California. Fishermen report that they have been able to operate for only a small number of days before having to move to another area or return to port due to high wind and rough seas. This has resulted in a substantial loss of fishing time.

In summary, Dr. Laurs said, a number of adverse factors have combined to affect the albacore fishery this year, resulting in one of the poorest fishing seasons in 25 years.

Albacore Fishing Advisory Operations Completed for 1977 Season

The albacore fishing advisory operations of the La Jolla Laboratory conducted during the albacore fishing season which begins in early July and ends about late October consist of the issuance of a bi-weekly Albacore Fish Bulletin in conjunction with the 15-day sea surface temperature charts and daily albacore fishing broadcasts. The ninth and final albacore fish bulletin for the 1977 season was issued on October 15; the final transmission for the 1977 fishing season of the daily albacore fishing broadcasts was made on October 14.

The broadcasts are prepared by Mr. Robert Nishimoto, Fishery Biologist at the La Jolla Laboratory. Due to excellent cooperation from a number of people, this year broadcasts were carried over six radio stations giving nearly complete coverage of the West Coast. The stations included WWD in La Jolla, California; NMC, Coast Guard at Point Reyes, California; KRED in Eureka, California; KBBR in Coos Bay, Oregon; KNPT in Newport, Oregon; and KAST in Astoria, Oregon. Radiofacsimile transmissions of weekly sea surface temperature charts intended for albacore fishermen was also suspended for the season in October.

Poster Presentation Describing Subarctic and Subtropic Fronts in Eastern North Pacific Made at Conference

At the La Jolla Laboratory R. Lynn, Oceanographer, prepared a poster presentation entitled, "A description of the subarctic and subtropic fronts in the eastern North Pacific" which was displayed at the Chapman Conference on Oceanic Fronts, sponsored by the American Geophysical Union, in New Orleans, October 10 to 14, 1977. The presentation included detailed oceanographic sections across the fronts that form the boundaries of the North Pacific Transition Zone based on the data collected during the 1976 albacore-oceanography survey aboard the NOAA research vessel, David Starr Jordan.

The closely-spaced stations (at 10 nautical miles) revealed the large, tight gradients of the fronts and some features not previously reported. Inversions in the salinity distribution in the Transition Zone (an area of convergence between subarctic and subtropical water masses) show multiple layers on the order of 30 and 40 mm thick. High and low salinity layers appear to project into the Zone from the saline subtropical waters and low salinity subarctic waters. Also, a narrow core of extra-high salinity water parallels the subtropical front (on the saline side) and extends to the full depth of the front. The high salinity water was traced for about 300 km and its form suggests a jet-like flow. Calculations of geostrophic velocity indicate a broad eastward flow of approximately 20 cm/second across the subtropical front with reversals or near-zero flow north and south of the frontal zone.

A time series of hourly salinity-temperature-depth (STD) casts over an inertial period was examined to show dynamic changes at intermediate depths (400 to 700 m). These changes may be interpreted as a short-term velocity fluctuation. The presentation also showed the year-to-year variability in the fronts and the association of albacore catches with the fronts and Transition Zone.

According to Lynn, the poster was well received and the conference provided opportunity for contacts with researchers who may be sources of related and complementary data.

Geostrophic Speeds about Subtropical Front Give Boost to Migrating Albacore

Lynn noted that the geostrophic speeds observed about the subtropical front would give migratory albacore a boost along their path of movement. The speed of the current, 20 cm/sec is equal to half of the minimum swimming speed (41 cm/sec) estimated for albacore by R. Dotson in a 1977 paper. A reasonable guess for a migration speed sustained over days or weeks may be 60 cm/sec. In a paper in press, Laurs and Lynn noted that catches of albacore were associated with northward protruding tongues of Transition Zone waters formed by meanders in the front. If the water flow associated with the front traces the same meander, as is expected, then the flow will assist the albacore into these pockets and delay their departure. Thus, the flow patterns observed about the fronts in June 1976 would assist albacore in their migration and, in local offshore regions, would tend to concentrate them in meanders.

East of 135°W the prevailing currents are directed southeast, presumably at right angle to the migration path, hence the effect of this change in current direction would displace the albacore laterally along their migration path.

* * * * *

NOAA Corps Lt(jg) M. Sullivan who has been assigned to the La Jolla Laboratory in the Albacore Fishery Program completed design and specifications for the Hewlett-Packard system controller cabinet. The manufacturer will try to deliver the equipment by November 21 and the entire instrument package should be ready for installation on the NOAA research vessel, Jordan, shortly thereafter. A new guildline salinometer for the Jordan has been received. Interfacing with the HP system controller should be completed by the beginning of the CalCOFI cruises in December 1977. The total system will permit automated data logging and display for the salinometer data.

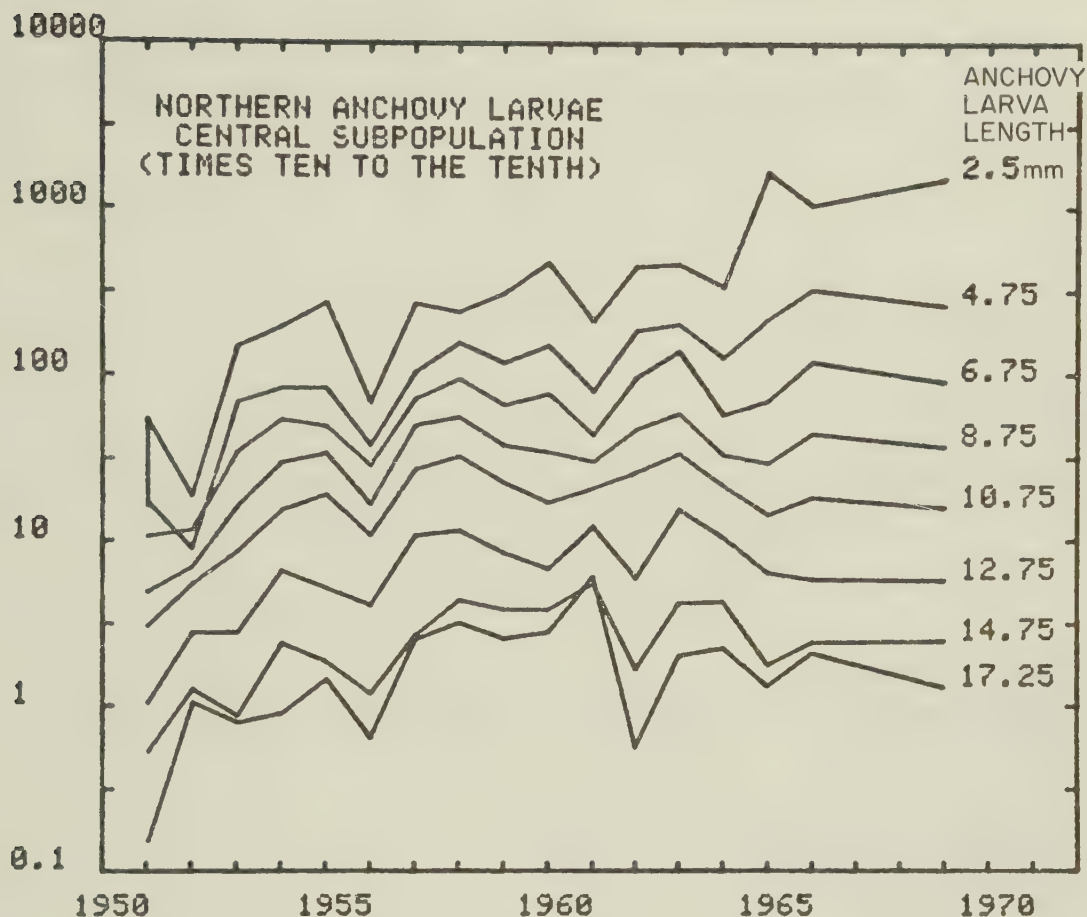
SURVEY SYSTEMS DEVELOPMENT AND EVALUATION PROGRAM

Estimates of Larval Anchovy Mortality Rates for 20-Year Period Completed

Fishery Biologist Paul Smith and Mathematician James Zweifel at the La Jolla Laboratory completed estimates of the larval anchovy population size by 1 mm length increments for the central subpopulation for the 20-year period, 1950-1970 (See Figure 1). This is a major scientific achievement since no other data set of this extent exists anywhere.

According to Division Chief Reuben Lasker it provides the most accurate estimates possible at our present level of knowledge over a span of 20 years. Virtually every known correction has been made to insure accuracy and precision of estimates, including adjustments for temperature specific growth, losses from extrusion through the sampling net, day-night differences in avoidance and other factors. In addition, statistical techniques developed by Mr. Zweifel permit the calculation of confidence interval statements for all estimates.

General features suggest a higher mortality during the period of onset of feeding and another occurring at about 11 mm in some years. Perhaps the most striking feature is that the data illustrate the dynamic process of mortality in larval fishes with patterns changing from year to year, with trends of increasing or decreasing mortality changing from size class to size class. These processes continue through the largest size class of larvae studies. The pattern of recruitment as evidenced by fluctuation in spawning biomass is not yet apparent.



One of the corrections for extrusion of anchovy larvae through the meshes of the plankton net is derived from research reported in a paper by Dr. William Lenarz, Fishery Biologist now at the Center's Tiburon Laboratory (Mesh retention of larvae of *Sardinops caerulea* and *Engraulis mordax* by plankton nets, U.S. Fishery Bulletin, Vol. 70, No. 3, 1972: 839-847). The extrusion calculations made by Dr. Lenarz are based on plankton tows taken in 1966 and 1967. According to Dr. Paul Smith, indications are now that a constant extrusion can only be assumed for a constant towing speed, and in 1951 the towing speed was, at times, a great deal faster than would be acceptable presently, possibly resulting in significant losses of larvae and an underestimate of the population.

Dr. Smith, with J. Zweifel, O. Burris and R. Butler have now begun a study in connection with the CalCOFI data base management project of the variable extrusion problem. This will entail refinements in the form and constants of the following equation, resulting in improvements in precision of the data:

$$Y = \{ \sin [-190.726 + 11.846 (\pm 1.137) L - 53.769 (\pm 7.747) \ln U - 304.733 (\pm 84.397) \ln A] \}^2$$

$$\text{angle} = \arcsin \sqrt{p}$$

$$\sin \text{angle} = \sqrt{p}$$

$$(\sin \text{angle})^2 = p$$

where Y is the proportion of larvae of size L retained by the net.

L is the standard length of larvae in mm.

U is the tow speed of the net in ms^{-1} .

A is the bar measure of aperture width of the mesh in the net.

LARVAL FISHES, COASTAL EASTERN PACIFIC PROGRAM

Expansion of Black Pigment Cells in Anchovy Larvae Appears Related to Ultra-Violet Dosage

At the La Jolla Laboratory, Fishery Biologist John Hunter reported that work continued on histological and morphological examination and quantification of the effects of ultra-violet irradiation on the eggs and larvae of mackerel and anchovy over the embryonic period. These studies, funded by the Environmental Protection Agency through a contract awarded to the Southwest Fisheries Center, show an exponential increase of lesions in brain and eye with dosage and a decrement in development. Preliminary analysis also indicates that the extent of melanophore (black pigment cells) expansion on the ventral portion of the gut also appears to be related to ultra-violet dosage.

* * * * *

Dr. John Hunter, Fishery Biologist at the La Jolla Laboratory, has completed a draft of a manuscript, entitled, "The behavior and ecology of marine fish larvae" which he will present at a conference on fish behavior and management at the Bellagio Conference Center in Italy in November, under the auspices of the Rockefeller Foundation. The invited paper reviews the behavior of larval fishes, with emphasis placed on behavioral traits that are diagnostic of specific ecological roles; such roles are considered in relation to causes of mortality.

High Survival and Growth Rates Found
in Larvae Fed on Wild Plankton

Dr. Nancy Moffatt, NOAA post-doctoral research fellow at the La Jolla Laboratory, is continuing to rear northern anchovy (E. mordax) larvae on wild-caught plankton in dense Chlorella (a green algae) blooms (7,000 to 12,000 cells/ml).

Rearing tanks containing Chlorella and supplied with wild plankton daily to maintain food levels at either 150/l or 300/l, unexpectedly developed Noctiluca (a dinoflagellate) blooms mid-way through the 16-day experiment. Since 99% of the wild-caught plankters (35 μ m to a maximum of 300 μ m) were various stages of copepods, diatoms and dinoflagellates were not included in daily plankton density determinations for each rearing tank. Therefore, Noctiluca levels were not being monitored during the experiment, but were found in excess of 200/l in tank 6 when the experiment was terminated.

Preliminary analyses of the results are summarized as follows:

Tank	<u>Chlorella</u> & food level (wild plankton)	Stocking number/density #/ # per liter	Survivors/ % survival	Mean larval length (mm)	Mean total growth (mm)
1	<u>Chlorella</u> only	130/2	0/0	-	-
2	<u>Chlorella</u> only	130/2	0/0	-	-
3	<u>Chlorella</u> + 150/l *	130/2	40/31	6.28	2.28
4	No <u>Chlorella</u> 300/l	130/2	1/0.8	7.10	3.10
5	<u>Chlorella</u> + 150/l *	130/2	82/63	6.64	2.64
6	<u>Chlorella</u> + 300/l *	130/2	109/84	7.01	3.01
7	<u>Chlorella</u> + 300/l *	130/2	51/39	6.73	2.73

* Denotes the presence of high densities of Noctiluca at the end of the experiment.

Upon examination, larval guts contained primarily very green Noctiluca, copepod nauplii and copepodites and concentrations of Chlorella.

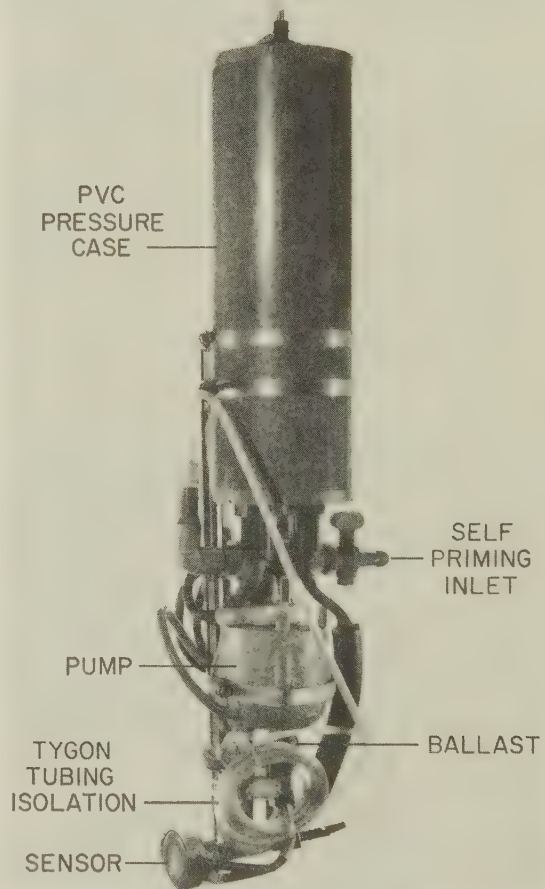
Noctiluca alone has been shown to be of little nutritional value for larval fishes. The Noctiluca sampled from the rearing tanks and observed in the larval guts contained large accumulations of Chlorella. Noctiluca collected in the field and present in the rearing tank without Chlorella were essentially colorless.

Exactly what provided the nutrients responsible for the unusually high survival and growth rates obtained is not known. Results, however, indicate the need to determine the nutritional role played by Chlorella in larval rearing systems.

Instrument for Oceanography Sampling of Particle Density and Size Developed at La Jolla Laboratory

Electronics Engineer Jack Brown, La Jolla Laboratory, presented a paper on his development of a microprocessor-based oceanographic particle data collection system at a meeting of the combined Marine Technology Society and Institute of Electrical and Electronic Engineers Conference - Oceans '77, in Los Angeles, October 17, 1977.

Mr. Brown has developed an instrument for oceanographic sampling of particle density and size versus depth and temperature in a 100-m water column. The sensor probe, although attached to a lightweight cable, is allowed to free fall, which effectively detaches it from the motion of the sampling platform and enhances the resolution of thin particle layers. Sensor information is transmitted up the cable to a small, dedicated, microcomputer module where it is digitized and stored on cassette tape with a read-after-write verification. The microcomputer also keeps the operator informed of the status of the drop and displays the recorded data on a video monitor.



This instrument has now undergone extensive tests at sea. In October, Mr. Brown reported that he was able to count and size particles in the range of 35 to 125 microns diameter for the first time without ambiguity, with a 500 micron diameter orifice.

Apparatus Completed to Measure Spawning Frequency in Anchovy

Mr. Roger Leong, Fishery Biologist at the La Jolla Laboratory, who has been principally responsible for developing techniques for spawning and rearing fish in the experimental sea water aquarium at the Southwest Fisheries Center, reports that the apparatus for measuring the spawning frequency and the interval between spawnings in anchovy was completed. Fish from the spawning brood stock maintained in the aquarium were used to stock 12, 10-foot diameter tanks containing only one female and 20 male anchovy. These tanks will be monitored daily to determine spawning frequency and intervals between spawning. Mr. Leong has thus far not been able to obtain any adult anchovy to stock the large swimming pools which also will be used in this study since only juvenile anchovy have been available from bait dealers for the last 4 months.

MULTISPECIES TAXONOMY PROGRAM

MARMAP Training Course Completed at La Jolla Laboratory

The 4-week MARMAP training course on the identification of fish eggs and larvae at the La Jolla Laboratory was concluded on October 5. Of the 18 participants from 7 countries who completed the course, three participants, Ms. Y. Babalola, Nigeria; Dr. F. Conand, France; Dr. C.B. Devi, India, remained at the laboratory to work on special projects.

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Biological Aid Connie Fain has temporarily transferred to the staff of the Multispecies Taxonomy program from the plankton sorting group to take over the larval fish identification duties of Elaine Sandknop who will devote a year to the identification of larval rockfishes.

Facilities Constructed for Rearing Larval Fishes

John Butler, Fishery Biologist, has completed construction of facilities for rearing larval fishes. Several short cruises were made to collect eggs of inshore fishes. Eggs of the basket weave cusk eel, Otophidium scrippsii, were found in abundance and were carried through the entire larval period on a diet of Brachionus, Tisbe and Artemia.

At about 25 mm length and 40 days of development, the fish began to settle to the bottom of the tank and burrow into the sand. This is the first time this species has been reared in captivity and the complete developmental series will aid in the identification of plankton-caught specimens.

Complete series of three species of turbot (Pleuronichthys) were also reared through metamorphosis. Dr. David Leighton provided eggs of two species of blennies (Hypsoblennius) and they were reared by Mr. Butler, Betsy Stevens and Susan d'Vincent.

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Dr. G. Moser, Acting Leader of the Multispecies Program, reported that several manuscripts were completed during October. A paper describing the eggs and larvae of five species of turbot (Pleuronichthys) and two other species of flatfishes by Barbara Sumida-MacCall, E. Ahlstrom and G. Moser was sent out for review.

Mr. John Butler's manuscript on the genus Cubiceps was completed for submission to the Bulletin of Marine Science. A manuscript on the life history of the blackgill rockfish, Sebastes melanostomus, by Drs. Moser and E. Ahlstrom was completed for submission to the Proceedings of the Los Angeles County Museum of Natural History.

COMMERCIAL & RECREATIONAL FISHERIES RESEARCH FOR MANAGEMENT PROGRAM

Second Draft of the Anchovy Fishery Management Plan to be Presented to Fisheries Council

The Anchovy Management Plan Development Team consisting of H. Frey and A. MacCall of the California Department of Fish and Game; G. Stauffer & D. Huppert of the La Jolla Laboratory; accompanied by J. McMillan, Economist at the La Jolla Laboratory, met with the Anchovy Advisory Panel in Long Beach on October 4 to discuss the Second Draft of the Anchovy Fishery Management Plan. Principal concerns raised by Panel members were: (1) the means of controlling the U.S. fishery in the absence of a bilateral U.S./Mexico treaty covering anchovy quotas, (2) the legal status and optimal use of area closures to prevent recreational and commercial fishers from conflicting, and (3) the adjustment of annual anchovy quotas to account for the sex ratio in the catch.

Program Leader, Dr. Dan Huppert, accompanied by CF&G Biologist, Alex MacCall, attended the Pacific Fisheries Management Council and Scientific and Statistical Committee meetings in Burlingame, California

on October 13-14, 1977. The Second Draft of the Anchovy Fishery Management Plan was presented to both the Council and the Committee. Additional changes were suggested, and the Council will consider for adoption the Second Draft with changes at the November 14-15 meeting in Los Angeles.

Fishery Economic Study Contracts Awarded

The two recreational fishery economic study contracts signed in September and October and to be monitored from the La Jolla Laboratory are getting underway. On October 17, Mr. Alfred Zangri and Mr. Phil Symonds of the Center for Natural Areas, Inc. visited the SWFC to meet with Dr. Huppert and Jane McMillan. The time schedule for completion of the survey design, survey procedure, and project reporting was developed for the study entitled, "Economic Analysis of the California Commercial Partyboat Passengers." The survey design should be sufficiently developed by December 1, to allow the proposal to be submitted to OMB for authorization. Actual survey work will probably begin in May for the partyboat passenger survey.

The other economic study contract, "Economic Profile of the California Live-Bait and Commercial Partyboat Fisheries," was awarded to Gruen, Gruen and Associates of San Francisco, California. Dr. Huppert traveled to San Francisco on October 26, 1977 to meet with Claude and Nina Gruen and Bruce Moorehead. The OMB approval procedures were reviewed and time scheduled, liaison with Center for Natural Areas, and industry and CF&G contacts were discussed.

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Mr. Joe Caruso, Mathematician at the La Jolla Laboratory, reports that he has edited the data for the 1970 aerial marine resources monitoring system, treating effort and sighting records separately. As a final edit procedure, each year, 1976-70, was merged. Every effort record was mated with its corresponding sighting records and cross-checks were made. All errors were corrected and these years are considered "clean" and ready to be put onto a date base.

Three Species of Rockfish Dominate Catch in Inshore Waters off Southern California

At the La Jolla Laboratory, John MacGregor, Fishery Biologist, reported the rockfish taken in the otter trawl during a Jordan cruise in September have been identified, measured, weighed and scale samples and otoliths removed. Only four species were taken: Sebastes semicinctus, 15%; S. saxicola, 23%, S. dallii, 59%; and S. chlorostictus, 3%.

Previous trawl samples taken by MacGregor and other investigators show that the first three species tend to dominate the rockfish catch in inshore waters off southern California.

Earlier trawl samples examined included the four species taken in September and five other species. If these trawl samples are added to the September data, the distribution of catch by species is:

<u>S. saxicola</u>	28%	<u>S. chlorostictus</u>	2%
<u>S. semicinctus</u>	25%	<u>S. hopkinsii</u>	1%
<u>S. dallii</u>	22%	<u>S. rubrivinctus</u>	1%
<u>S. miniatus</u>	14%	<u>S. rosaceus</u>	1%
<u>S. paucispinis</u>	6%		

The trawl-caught rockfish are especially useful for determining early growth. Seventy-two percent (72%) of these fish have been less than 100 mm standard length.

U.S.-U.S.S.R. Cooperative Egg & Larva Survey Scheduled

The 1978 U.S.-U.S.S.R. cooperative egg and larva survey out of the La Jolla Laboratory has been scheduled to begin the week of February 20, 1978. This should coincide with the peak of Pacific hake spawning and will be half-way between the 7802 and 7803 CalCOFI cruises.

Scheme Developed to Aid Decision Makers in Selecting Harvest Quota Policy for Anchovy

Dr. Gary Stauffer, Fishery Biologist at the La Jolla Laboratory, has developed a scheme for objectively selecting a harvest quota policy for the anchovy fishery management plan when there are evaluation of more than one criterion. Generally, decision-makers are faced with subjectively choosing one option over the other based on their conception of which is the better. Dr. Stauffer's scheme standardizes the criteria values to mean of the criteria and then assigns weights to each criterion. The option that has the highest sum of the product weight times standardized-criterion is the best option to select. In practice, this scheme is meant to aid decision makers in evaluating their subjective selection of options and not necessarily a replacement of the process. It provides them with a procedure to determine how much weight must be given to each criterion before a particular option appears to be the best.

Dr. Stauffer also devised an anchovy spawning biomass estimation procedure for years without egg and larva surveys. This spawning biomass forecast is based on the presently operational triannual CalCOFI survey estimates as modified by subsequent age composition data obtained by CF&G sea surveys and commercial fishery sampling.

The fundamental assumption of this procedure is that spawning biomass is fully available to the midwater sea survey or the commercial fishery. This implies that the age composition by weight of the spawning biomass is the same as the age composition of mature fish in the samples.

A preliminary evaluation of this procedure for the years 1972 to 1975 gave dismal results. Errors in the biomass estimate tend to accumulate so that second year updates exhibit greater errors than the first year update.

It appears from the preliminary study that younger ages in the spawning biomass are not fully available to the midwater trawl survey or the commercial fishery. Practical application of the method awaits additional research and trial testing.

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Efforts by Dr. Stauffer to start the development of a preliminary management plan for Pacific saury were delayed because of the required revisions for the second draft of the Anchovy Management Plan.

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Statistician Keith Parker, La Jolla Laboratory, continued his work on the editing of anchovy vessel logs. He reported that editing was completed on three vessels, consisting of approximately 6,000 records. A program was implemented to create subfiles of trips and sets for any given species or combination of species.

Mr. Parker also continued work on the "best mix" method of assessing the biomass of the central stock of anchovies. Mr. Parker is attacking the "best mix" problem from the direction of evaluating technologies for estimation of absolute abundance, evaluating technologies for relative abundance estimation, proposing best mix models and research direction. He reports that the first phase of this project is nearly completed and estimated that all phases should be completed by the first of December.

Oceanic Fisheries Resources Division

PORPOISE/TUNA INTERACTION PROGRAM

Leader of Porpoise/Tuna Interaction Program
Transfers to Washington, D.C.; Porpoise/Tuna
Research at Center to be Reorganized

John Everett, Leader of the Porpoise/Tuna Interaction Program since January 1976, transferred to Washington, D.C. as Chief of the Division of Industry and Consumer Services in the NMFS Office of Fisheries Development.

With the departure of Mr. Everett, Director Barrett has decided to reorganize porpoise/tuna research in the Oceanic Fisheries Resources Division at the La Jolla Laboratory into two programs in order to make the research more manageable. Since Mr. Everett arrived, the budget of the program has grown almost four-fold and the complexity of the overall research program and number of personnel involved has grown commensurately with the growth in budget.

The proposed revision of the program structure involves a consolidation of the more quantitatively-oriented functions into one program and the biological, gear, and behavioral functions into a second program.

The Center is presently advertising to get the best-qualified applicants for both program leader positions which will be in the Fishery Biologist series.

NMFS to Charter Tuna Vessels for Porpoise Gear Research

Within the Porpoise/Tuna Interaction Investigation at the La Jolla Laboratory, the staff involved in research on reduction of porpoise mortality devoted much of its time to negotiating for chartered research cruises. The first charter cruise to conduct gear dynamics and behavioral studies is being carried out aboard the Class III (carrying capacity of 600 or more short tons of tuna) purse seiner, Margaret L, which left San Diego on October 25, 1977. The primary purpose of this cruise is to conduct gear and behavioral experiments to reduce incidental porpoise mortality in commercial tuna seining operations. Detailed studies will be made of the overall dynamics of the backdown channel in the tuna seine and the behavior of porpoise and tuna in relation to modifications of the seine in the backdown apex. Studies will also be made of the behavior and physiology of porpoise during prolonged containment, methods will be investigated of herding porpoise within the net during all phases of the tuna set, and experiments will be continued of the "roll-up" prevention techniques begun aboard this vessel in May 1977.

The second charter, utilizing a smaller seiner, the Maria Marie, should begin in early November. This cruise is designed to test the effectiveness of the super apron aboard a Class II (greater than 400 tons carrying capacity tuna purse seiner and built before 1961).

NOAA Research Vessel, Jordan, at Mid-Point of Porpoise/Oceanography Cruise in Eastern Tropical Pacific

The NOAA research vessel, Jordan, has completed the first of two legs of a porpoise/oceanography cruise in the eastern tropical Pacific.

The Jordan departed San Diego on October 3 only to return to port on October 6 to repair a faulty generator and to avoid an approaching storm. After a brief stay for repairs, the Jordan set sail again on the evening of October 6.

After arriving in Lima, the Jordan's chief scientist, NOAA Corps Officer Lt. Wayne Perryman was replaced by Dr. David Au, Fishery Biologist at the La Jolla Laboratory, for the return trip to San Diego. The vessel is expected to return on November 22.

This cruise will help provide information which will add significantly to the temporal-geographical picture of the distribution of pelagic porpoise populations in relation to oceanographic parameters.

Morphological Differences Found Between Porpoise Populations

Dr. William Perrin, Leader of the Porpoise Life History and Systematics group at La Jolla, reports that his staff recently completed a manuscript on the results of a study comparing the "southwestern" spinner and spotter porpoise with animals of those species located further north and east. The paper is based on observations taken during the cruises of the Soviet whaling vessel, Vnushitelnyi, and the NOAA research vessel, David Starr Jordan, as well as samples collected from tuna seiners. Comparisons involved color patterns, external size and shape, and skeletal structure.

The report concluded that there is a morphological difference between porpoises found in this "southwestern" region and the porpoises located immediately to the north.

Research Planned for Tuna Industry Dedicated Vessel

Members of the Porpoise/Tuna Interaction staff met with representatives of the U.S. Tuna Foundation, the Marine Mammal Commission, and the National Science Foundation to discuss the types and objectives of research planned for the vessel which the U.S. tuna industry is donating in 1978 for research on the porpoise/tuna interaction. The primary overall objectives are porpoise mortality reduction and stock assessment. Some of the activities include studies on gear modification, acoustics, behavior, and whole school examinations and tagging. The latter is needed for data on school cohesion and tag shedding rates. This information is critical for the experimental design of the large-scale porpoise tagging program. Most of the work on tag design and development is being conducted at the National Fisheries Engineering Laboratory, Bay St. Louis, Mississippi, and at the Hubbs-Sea World Research Institute, San Diego, California.

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Planning also continues at the La Jolla Laboratory for the aerial/ship stock assessment survey of porpoise in the eastern tropical Pacific

scheduled for early 1979. At present a survey is planned similar in scope to the one conducted in 1977 utilizing one airplane and two research vessels.

TUNA RESOURCES PROGRAM

Papers Submitted to the International Commission for the Conservation of Atlantic Tunas

The following working papers were completed in October 1977 by staff members of the La Jolla Laboratory's Tuna Resources program. They were submitted to the International Commission for the Conservation of Atlantic Tunas (ICCAT) for the November scientific meeting in Madrid, Spain:

Bartoo, N. and G. Sakagawa. Size frequency of bigeye tuna (Thunnus obesus) in the catch of the Atlantic surface fishery, 1969-1975.

In this paper Drs. Bartoo and G. Sakagawa present information on length-frequencies from the bigeye tuna catches for 1967-1975 to assess the possible impact of the 55 cm yellowfin tuna minimum size limit on the bigeye tuna catch. Available length-frequencies of bigeye tuna by gear and fleet are used to estimate the length composition of bigeye tuna in purse seine catches for 1967-1974 and baitboat catches for 1972-1975. For 1967-74, an average of 10.3% of the purse seine bigeye catch was less than 55 cm. The percentage of baitboat-caught bigeye tuna less than 55 cm for catch years 1972, 1973, 1974 and 1975 was 30%, 98%, 70% and 93% respectively. Length-frequencies for 1972 and 1973 French Ivory Coast-Senegalese baitboat-caught bigeye and yellowfin tunas were compared; there is a shift toward smaller bigeye tuna sizes in 1973 and little change in yellowfin tuna sizes. Length-frequencies for yellowfin and bigeye tunas are compared for combined 1976 single landings data from Tema-based baitboats. The limited data show a coincidental peak in the catch-size frequency slightly below 55 cm for both bigeye and yellowfin tunas.

Weber, E.C. and G.T. Sakagawa. Production model analysis of bigeye tuna (Thunnus obesus) from the Atlantic Ocean, 1965-1975.

The authors report that bigeye tuna (Thunnus obesus) in the Atlantic Ocean continue to be exploited at high levels. The 1975 catch of 50,597 metric tons was slightly below the 1974 record catch of 52,352 MT. Although longlining remains the principal method of capture, accounting for 67% of the 1975 catch by weight, the surface fishery is expanding.

Bigeye production in the Atlantic Ocean for 1965-1975 was evaluated using the generalized production model with the following assumptions: 1) separate north and south stocks and 2) a single exploited stock. The best fits were obtained with a flat-topped ($m = 0$) equilibrium yield model. While the available data for the south Atlantic fit the model reasonably well, data for the north and entire Atlantic did not and the

resulting predictions for maximum average sustainable yield (MASY) seem unrealistically high. The authors conclude that the "best" MASY prediction for the southern fishery is 17,100 tons.

Fox, W., Jr. and A. Coan. Production model analysis of Atlantic yellowfin tuna (Thunnus albacares), 1964-1976.

The generalized stock production model was used to evaluate the status of Atlantic yellowfin tuna for 1964-1976. Previous analyses (Coan and Fox, 1977) were updated. The conclusions of previous years, that no significant increases in sustainable yellowfin tuna catches could be made without a major change in the constitution of the fishery, remains valid. The effect of one major change in the constitution of the fishery, i.e., development of a major offshore surface fishery results, thus far, in increased estimates of the maximum sustainable average yield (MSAY) of 10,000 to 30,000 tons for the eastern Atlantic surface fishery and for the total Atlantic fishery. Currently, the best estimates of MSAY are derived from a broad, flat-topped yield curve ($m=P$); they are 112,000 MT for the eastern Atlantic surface fishery and 138,000 MT for the total Atlantic fishery. These estimates of MSAY, however, theoretically occur at infinite fishing effort and the estimates of sustainable yield at 1976 levels of effort are 76,000 and 99,000 MT respectively for the eastern surface and total fisheries. The actual 1976 catches were 90,000 MT (eastern surface) and 112,000 MT (total Atlantic), so if effort and the constitution of the fishery remain constant, the future catches of Atlantic yellowfin should average 13,000-14,000 MT less than the 1976 level.

Sakagawa, G. and J. Uchiyama (Honolulu Laboratory). Age and growth of Atlantic skipjack tuna (Katsuwonus pelamis) from daily growth increments in otoliths.

A study on age and growth of Atlantic skipjack tuna based on daily growth increments of sagittae (otoliths or ear bones) was begun. Results thus far from eight specimens suggest that skipjack tuna from the Atlantic grow at a much faster rate than previously believed. Estimates of average length at age are 42 cm for 1-year old fish and 68 cm for 2-year olds.

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In addition, the staff of the Tuna Resources program prepared a document, "Review of United States fisheries and research activities on tunas and tuna-like fishes of the Atlantic Ocean for 1976-1977: for submission at the ICCAT meeting in November. The document summarized U.S. participation in the Atlantic tuna fishery and related research activities.

Tuna Vessels Participate in Fisheries
Service FAX Program

During October, 22 U.S. tropical tuna vessels participated in the FAX program of the La Jolla Laboratory.

	<u>Weather Observations</u>	<u>XBT Observations</u>	<u>Total</u>	<u>Total year to date</u>
1976	135	5	140	2,453
1977	177	6	183	1,788
Percent change	+31	+20	+31	-27.1

The tuna seiner, Santa Rosa, again led all cooperating vessels in October with 22 weather observations and 4 XBT observations sent to the Southwest Fisheries Center via radio station WWD at the University of California, San Diego. The Santa Rosa's reports comprised 14.2% of the total number sent in; congratulations are due to Captains Noah and John Gomes of the Santa Rosa who have contributed the largest number of observations during seven of the ten monthly periods in 1977. Their observations comprise 19.6% of all observations radioed to WWD thus far in 1977 by cooperating purse seiners.

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The September issue of "Fishing Information" went to press on October 25. Two supplements with the Albacore Bulletin attached were issued during the month.

PACIFIC ENVIRONMENTAL GROUP

OCEAN MODELING AND FORECASTING

Sustained Vigorous Coastal Upwelling Characterizes
1977 Season in California Current

The season of sustained vigorous coastal upwelling in the California Current has come to a close, and the gross characteristics of the 1977 upwelling season, as indicated by the PEG "monthly upwelling index" is now apparent. Major features shown in the figure on page 28 include:

1. Continued anomalously strong upwelling off Northern California.

Upwelling index values at 39°N lat. for March, June and July of 1977 are the highest for those months in the entire 32-year (1946-66)

time series. Only in May does the value at 39°N fall below the median for that month. Thus, 1977 continues the unprecedented series of very strong upwelling years off northern California which commenced in 1973. The relationship established prior to 1972, indicating values, appears to be holding through this recent very unusual period.

2. Widespread anomalies in March and May.

Very high upwelling index values during March extend from south of Cabo San Lucas to the northern extremity of the Gulf of Alaska (where they indicate abrupt relaxation of the winter downwelling situation). During May values were very low from the Washington coast to northern Baja California, but high in the Gulf of Alaska and off southern Baja California.

3. Generally strong upwelling off southern Baja California.

Except for the month of January, index values of 27°N lat. and southward have been in or near the upper quartile of the various month-location distributions throughout the first 9 months of this year.

TIBURON LABORATORY

FISH COMMUNITIES INVESTIGATION

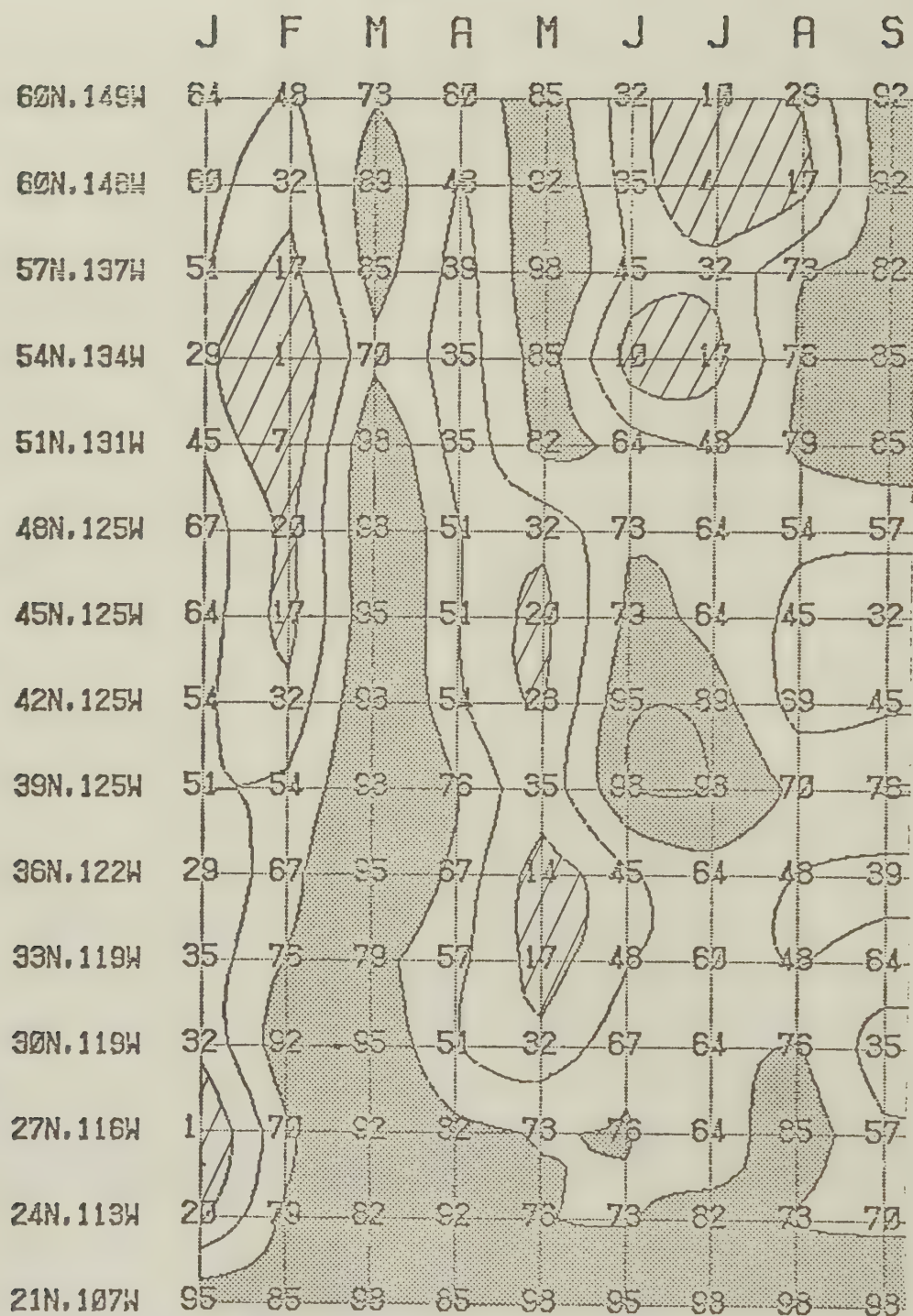
Investigation Members Attend Meeting of Groundfish Management Plan Development Team

Dr. William Lenarz, Leader of the Rockfish Analysis Task, and Economist Edward Ueber at the Tiburon Laboratory, attended a meeting on October 12 and 13 of the Groundfish Management Plan Development Team in Seattle. Members were assigned tasks in preparing the Management Plan. Dr. Lenarz agreed to prepare sections on shortbelly and darkblotched rockfish, in addition to the tasks previously assigned to him. The team also discussed progress in awarding a contract to estimate the economic parameters of the groundfish fleet. Mr. Ueber is to represent the team in awarding and monitoring this contract, in addition to his existing commitment as a member of the Dungeness Crab Management Plan Development Team.

Progress of Rockfish Analysis Task Reviewed

On October 20, Dr. Lenarz presented a progress report on the Rockfish Analysis Task to the Tiburon Laboratory Research Council. Discussion covered first approximations of optimum size at recruitment of the important rockfish species in the San Francisco Bay area partyboat fishery, as well as preliminary results, and 1978 projections for the experimental management of the fish community at the Laboratory dock.

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Monthly upwelling index values for the first three quarters of 1977, in terms of percentiles of the frequency distributions made up of the 32 values for each month and location in the 32-yr (1946-77) time series. Locations in the Gulf of Alaska are toward the top of the figure; those off Baja California are toward the bottom. The contour interval is 25 percentiles. Values above the 75th percentile, indicating much stronger than normal seasonal upwelling, are shaded. Values below the 25th percentile, indicating anomalously weak upwelling (or anomalous downwelling) are diagonally hatched.

Mr. Peter Adams, Fishery Biologist with the Rockfish Analysis Task at Tiburon, prepared a talk for presentation at the CalCOFI meeting to be held in La Jolla in November on trophic interactions among members of the fish community laboratory dock, which presently is the subject of an experimental management scheme. His talk centers on the significance of trophic relationships in adapting management strategy. He defines two major categories among the species in this community based on morphological and dietary characteristics, and points out these are high measures of trophic overlap among members of each category. He concludes that these high measures of overlap suggest that harvesting any member of either category independent of other members of that category could create competitive instability.

Rockfishes Tagged at the Farallon Islands

Ms. Tina Echeverria, Fishery Biologist with the Rockfish Analysis Task, reported that during the monthly tagging trip to the Farallon Islands 21 yellowtail rockfish were tagged and returned to the water in excellent condition. One rosy rockfish, a species that usually cannot tolerate being brought to the surface from the depths in which it lives, survived tagging.

U.S.-U.S.S.R. Symposium Fails to Materialize

During this month, Dr. Edmund Hobson, Leader of the Nearshore Fish Communities Task at the Tiburon Laboratory, wrote a manuscript entitled, "Impact of the environment in tropical and temperate latitudes on community structure in teleostean fishes," which he intended to present at the U.S.-U.S.S.R. Symposium on coastal ecosystems at Tallin, Estonia. At the last moment--with the U.S. representatives assembled in Washington, D.C.--the trip was canceled owing to problems in obtaining the Russian visas. Dr. Hobson plans to modify his manuscript and submit it to one of the scientific journals.

FISHERIES DEVELOPMENT INVESTIGATION

Midwater Trawl Readied for Experimental Fishery Trials on Rockfish

Mr. Sus Kato, Leader of the Fisheries Development Investigation at the Tiburon Laboratory, reports that gear is being prepared for the first experimental fishing trials to catch yellowfin and widow rockfish with a midwater trawl. The trawl has a 90 ft. headrope and consists of 4-1/2" and 5" mesh. A Furuno net recorder will telemetrically monitor the position of the net relative to fish and the sea bottom. The equipment is being installed aboard the fishing vessel, Cape Wendy, where Captain/owner Don Carter has donated time, crew, and expenses for this trial. The vessel is berthed at Bodega Bay, and is expected to fish at nearby Cordell Bank.

Talks with potential buyers indicate that enough of a market exists presently to keep a couple of vessels fishing all winter, pending agreement of price with the fishermen. A larger market also exists, if the price can be lowered to about \$500-600/ton. Mr Kato intends to experiment with a midwater trawl to learn catch rates and determine economic feasibility of the fishery.

Tagging & Freeze-Branding of Captive Silver Salmon Resumes

Mr. Roger Green, Leader of the Recreational Fisheries Improvement Task at the Tiburon Laboratory, has resumed tagging and freeze-branding of the 5,489 fish held over from September for an additional 30-day growth period. Both Carlin tags and freeze brands were applied to 3,156 silver salmon. One release of 2,582 fish has occurred to date. Tagging mortality for this group was 12 fish (0.5%).

Recoveries of previously released salmon continued. Eight gill net sets produced nine silver salmon, one king salmon, and one steelhead. Two of the returning silver salmon, including the largest individual recovered this season, were females. All other returning salmon have been males. Scale samples were taken from the gill-netted fish for preliminary studies on age determination. Eighteen king salmon tags from the 1976 release have been recovered from the ocean fishery so far this year. One silver-salmon tag, from the 1977 release, was returned. This fish was caught in the Bay, in the area referred to as California City.

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During the month, Ms. Susan Smith continued work on the manuscript, "San Francisco Bay Fisheries: Past, Present and Future." By the end of the month, three more draft sections had been completed, describing the molluscan, shad and surfperch resources within the Bay.

Press Run Scheduled for Anglers' Guide to the United States Pacific Coast

This month final corrections on the "Anglers' Guide to the United States Pacific Coast" were made by the GPO contract printer in Klamath Falls, Oregon. Unbound copies will be sent to the authors for approval just prior to the press run, which is scheduled for next month.

PHYSIOLOGY INVESTIGATION

Experiment Continues to Test Effects of Different Food Rations on Young Striped Bass

An experiment testing the effects of different rations of live adult Artemia (brine shrimp) and Neomysis (mysid) on young-of-the-year striped bass juvenile growth and survival is currently in its seventh week at the Tiburon Laboratory. Artemia, on a wet weight basis, appears to be less nutritious than Neomysis. Striped bass in all rations of Artemia have slower growth rates and lower survival than do the Neomysis-fed striped bass. The maintenance growth level is between 5 and 10% body weight per day.

Work continued on laboratory processing of samples from experiments conducted last spawning season.

The processing of samples for a study on the energetic processes of pre-feeding striped bass embryos and larvae was completed, and data analyses are underway.

Experiment Conducted on Effect of Crude Oil on Spawning Clams

Preparation and analysis of water and tissue samples from food chain experiments continued during the month at Tiburon. A 4-day experiment on the effects of the water-soluble fraction of Cook Inlet crude oil on spawning clams (Tapes semidecussata) was conducted. The results are being analyzed for a paper to be presented at the Symposium on Pollution and Physiology of Marine Organisms in Georgetown, South Carolina on November 14 by Dr. Jeannette Whipple. The title of the paper is "Effects of water-soluble petroleum hydrocarbons on some spawning marine organisms" by Jeannette Whipple, Tom Yocom, Ross Smart and Meryl Cohen.

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Chemist Pete Benville, working with other Task personnel at the Tiburon Laboratory, has increased the sensitivity of oil analytical techniques through the acquisition of a new type of detector for gas chromatography. With this photoionization detector, it may be possible to detect petroleum hydrocarbons in concentrations more than 100 times lower than is possible with conventional flame ionization detectors. Mr. Benville is preparing a manuscript on the detector for presentation at the American Chemical Society meeting next September.

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Dr. Fred Weiss, Research Chemist from Shell Oil Company, visited the Physiology Laboratory recently to discuss research at the Tiburon Laboratory with monocyclic aromatic hydrocarbons. There has been increased interest recently in the lab's work with benzene as a result of other studies showing it to be a potential carcinogen and also because it occurs in industrial effluents on the east coast. Some of the work with benzene and toluene has been abstracted in the Chemical Engineering News. The staff is preparing an updated list of publications and will be sending this list and reprints to several agencies and universities which have expressed interest.

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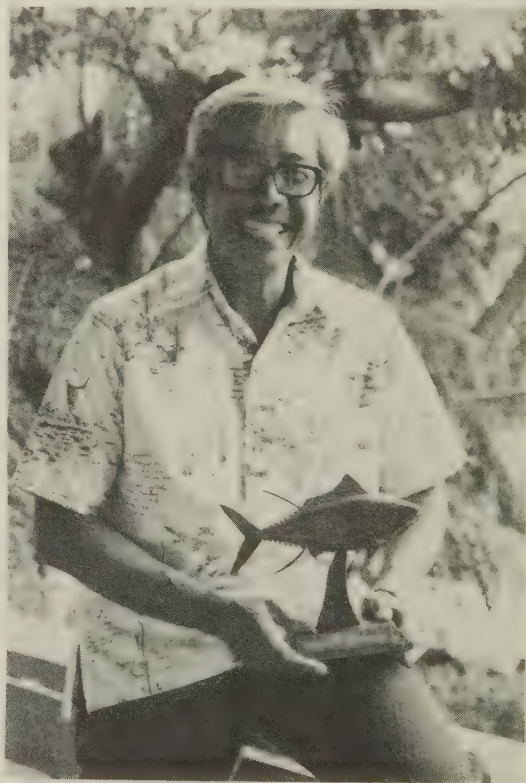
Dr. Jeanette Whipple and Tom Yocom have reviewed a section of the EPA "Red Book" for the American Fisheries Society. The section reviewed was on the EPA criteria for oil and grease.

HONORS AND AWARDS

Honolulu

At a dinner meeting on October 27, the Hawaii Big Game Fishing Club presented Mr. Heeny Yuen, Fishery Biologist at the Tiburon Laboratory, with a trophy, a carved, wooden replica of a yellowfin tuna, in appreciation for his work in recreational fisheries.

- August 10 - Computer Aid Richard Dyer, Cash Award - La Jolla Laboratory
- September 11 - Joanne Webber, Secretary, Oceanic Fisheries Resources Div., La Jolla Laboratory - Quality Step Increase.



Heeny Yuen

S RELEASE

October 12 - "Public invited to visit NOAA ship, research facility."
Issued by the Honolulu Laboratory.

IC AFFAIRS

Honolulu Laboratory Hosts Open House in
Observance of NOAA Anniversary

Over 600 persons toured the Kewalo Basin Research Facility and the Townsend Cromwell on Sunday, October 16, from 10 a.m. to 4 p.m., during the Open House held by the Honolulu Laboratory in observance of the seventh anniversary of NOAA. Commander Edward Gelb, Commanding Officer, and all the officers and crew were on hand to describe the scientific gear and facilities on board the Cromwell. Honolulu Laboratory scientists put up displays and were available to describe recent accomplishments in fishery research. Included in the displays were pools containing live fish and crustacean specimens from the NWHI and a large assortment of fresh seafood that were sent from sister NMFS laboratories at Tiburon and the Northwest and Alaska Fisheries Center. Also on display were several live kawakawa, Euthynnus affinis, including one which was fitted with a temperature sensitive ultrasonic transmitter. This display was used to illustrate the telemetry techniques used to measure body temperatures and other parameters from free-swimming fish by researchers in the Experimental Ecology of Tunas Task.

Other NOAA agencies participated in the Open House by putting up displays, including the Western Pacific Program Office, Southwest Region and the International Tsunami Information Center.

* * * * *

Dr. J. Powers, Leader of the Porpoise Stock Assessment Task at the La Jolla Laboratory, presented talks on the research conducted here on porpoise/tuna interaction to two school groups on October 10. In the morning he spoke to 20 students at the Golden Avenue Elementary School in Lemon Grove and later the same day to 20 students at the Mt. Vernon Elementary School in San Diego.

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Open House - Honolulu Laboratory

- October 3 - Ms. Tina Echeverria, Fishery Biologist, gave a talk at San Francisco State University on "Primary sexual differentiation among fishes."
- 6 - Mr. Chris Dewees of UC-Sea Grant, Davis, California hosted a group of Australian fishermen at a meeting in the Tiburon Laboratory Conference Room. This group had been touring commercial fishing facilities throughout the United States.
- 12-13 - Film shows and salmon-feeding demonstrations were presented by salmon project personnel of the Tiburon Laboratory for two youth groups, numbering approximately 70 children.
- 31 - Ms. Tina Echeverria presented a talk at San Francisco State University entitled "Factors influencing speciation in rockfishes."

SEMINARS

La Jolla Laboratory

- October 17 - Fishery Biologist Paul Smith presented a lecture entitled, "Acoustic surveys in the frequency domain," at a regularly scheduled seminar.

Tiburon Laboratory

- October 7 - Dr. Edmund Hobson presented a talk at the Tiburon Laboratory on "Community structure of reef fishes in the Hawaiian Archipelago."
- 27 - Mr. Peter Adams gave a talk at the Tiburon Laboratory entitled "Trophic interactions among members of a model fish community."

MEETINGS AND TRAVEL

- October 1-6 - Mr. R. Shomura, Director of the Honolulu Laboratory, travelled to California on baitfish project business, attended the 28th Tuna Conference at Lake Arrowhead, and was at the SWFC for the Center Management Meeting.
- 2-5 - Mr. D. Mackett, Center Program and Planning Officer, in Washington, D.C. to attend a National Data Management Committee.

- October 2-5 - Messrs. I. Barrett, N. Bartoo, D. King, D. Au, and E. Weber at Lake Arrowhead to attend the 28th Annual Tuna Conference. Dr. Laurs also attended and remained for the 24th Eastern Pacific Oceanic Conference (EPOC).
- Talks by NMFS personnel at the Tuna Conference included:
- "Remote sensing: with applications to the exploitation and management of tuna stocks by Dick Evans, presented by Earl Webber.
- "The application of polynomial-distributed lag models to problems in fish population dynamics, presented by Dr. Dennis King.
- "North Pacific albacore migration and stock structure," presented by Dr. Michael Laurs.
- "Distribution of porpoise in the eastern Pacific," presented by Dr. David Au.
- A talk was also presented by Dr. Man-Loong Chan of Tetra Tech entitled, "Global tuna systems model - a management tool." Tetra-Tech is working on a global tuna systems model under contract to the NMFS Southwest Fisheries Center.
- October 3-5 - Dr. Adams and Dr. Skillman attended the Lake Arrowhead Tuna Conference.
- 5 - Messrs. R. Lasker, R. Lynn and J. Squire at Lake Arrowhead for EPOC Conference. Dr. Lasker presented a talk on post-IDOE plans for the next ocean decade.
- 6 - Dr. D. Huppert in Monterey to meet jointly with the Squid Management Plan Team and Squid Advisory Panel.
- 6-7 - The top management of the Southwest Region (Messrs. Abramson, Barrett, Fox, Howard, Lasker, Mackett, Remington, Seckel & Shomura) attended the Quarterly Center Management meeting at La Jolla.
- Mr. Susumu Kato, Tiburon Laboratory, traveled to Monterey to attend a joint meeting of the Squid Management Plan Development Team and Squid Advisory Panel.
- 7-11 - Dr. Ed Noda, Director, Look Laboratory, met separately with Mr. Otsu and Mr. Shomura of the Honolulu Laboratory, to discuss possible participation of the Look Laboratory in fishery related research.

- October 9-12 - Ms. J. Jennings, Fishery Biologist, La Jolla Laboratory, traveled to the National Fisheries Engineering Laboratory at Bay St. Louis, Mississippi to review progress on tracking of porpoise with satellites.
- 9-14 - Ms. Hazel S. Nishimura, Librarian, Honolulu Laboratory, attended the Federal Interagency Field Librarian's Workshop held at New Orleans, Louisiana.
- 10-12 - Mr. J. Coe, Fishery Biologist, La Jolla Laboratory, in Bay St. Louis to attend a meeting on development of "whole school" porpoise tagging apparatus with contractors and consultants.
- 10-14 - Dr. M. Laurs and Mr. R. Lynn, Oceanographers at the La Jolla Laboratory, attended a meeting devoted to oceanic fronts sponsored by the American Geophysical Union, American Meteorological Society, and the Office of Naval Research. Mr. Lynn presented a paper, one of 80 given at the conference.
- 11 - Mr. Abramson attended a meeting of the Marine Resources Center Advisory Board in Eureka, which is considering the formation of a marine research center for the Eureka area.
- 11-13 - Data Systems Manager F. Kellenberger, La Jolla Laboratory, in San Francisco to attend an Automatic Data Procurement workshop.
- 12-13 - Center Director Barrett and Dr. D. Huppert of the La Jolla Laboratory, Mr. E. Ueber of the Tiburon Laboratory, and Dr. R. Parrish, Pacific Environmental Group, attended the Pacific Fishery Management Council meeting in San Francisco.
- 16-21 - Dr. William Fox, La Jolla Laboratory, in Mexico City to attend the Inter-American Tropical Tuna Commission annual meeting.
- 16 - Mr. Shomura departed Honolulu for Cochin, India to attend the Indian Ocean Fisheries Council meetings.
- 17 - Mr. Gordon Shadoan, Chief, Personnel Division, NASO, Seattle, briefed Acting Director Otsu and program and task leaders in preparation for a Department of Commerce Personnel Management Review at the Honolulu Laboratory.

- October 17-21 - Mr. Gunter R. Seckel and Dr. Douglas McLain attended the Climate Diagnostic Workshop at the Scripps Institution of Oceanography in La Jolla.
- 18-19 - Mr. Mackett in Menlo Park, California to attend a Fishery Information Systems Advisory Committee meeting.
- 19 - Mr. Abramson attended a meeting of the Fishery Information System Advisory Committee at the Rodeway Inn, San Francisco.
- 21 - Director Barrett met with NASO Director of Personnel, Gordon Shadoan in Seattle, Washington.
- 24-26 - David Mackett, Program and Planning Officer, for the Southwest Fisheries Center, traveled to Washington, D.C. to attend a Management Information Systems conference.
- 24-27 - Charles Hill, Head of Scientific Support Services at the La Jolla Laboratory, in Seattle, Washington to meet with field finance office and administrative operations personnel to improve and expedite work processes.
- 25-26 - Dr. Fox, Dr. Sakagawa and Mr. Barrett attended the ICCAT Advisory Committee meeting in Washington, D.C. Discussions centered on the yellowfin, skipjack, albacore and bigeye tunas of the atlantic and with members of the staff of the Southeast Fisheries Center, on bluefin tuna and billfishes. The ICCAT intensified skipjack research program was also discussed. Recommendations by the SWFC staff on the total program were well received and subsequently endorsed by the ICCAT Advisory Committee.
- 26 - Mr. Paul Sund and Ms. Kathy Setbacken conferred with Chief and Staff at PEG in Monterey.
- 27 - Center Director Barrett in Washington, D.C. to discuss scientific and administrative matters with Washington office staff.
- 31 - Mr. Abramson attended the Department of Commerce kickoff meeting in connection with the Personnel Management Evaluation team's visit to California and Hawaii October 31 to November 11. Ms. Elsa Porter, Assistant Secretary of Commerce, and Mr. John Golden, Director of Personnel, addressed the meeting.

October 31 -

- November 4 - Dr. Richard Parrish, PEG, attended the CalCOFI meeting in La Jolla.

VISITORS

Honolulu Laboratory

- October 3 - Mr. Roger Pflum of the Marine Resources Section, Palau, visited Mr. Otsu.
- 11 - Mr. Mike McCoy, Fisheries Officer, Ponape, met with Mr. Shomura to discuss future Ponape fishery plans.
- 11-12 - Mr. George Habib of the Fisheries Research Division, Ministry of Agriculture and Fisheries, Wellington, New Zealand. Mr. Habib was en route home after attending the Tuna Conference at Lake Arrowhead. He met with Mr. Shomura and other Honolulu Laboratory staff members during his layover.
- 13 - Mr. Bennie Rohr, Pascagoula Laboratory, Southeast Fisheries Center, visited Mr. Shomura. Mr. Rohr was vacationing in Hawaii and was interested in seeing the Honolulu Laboratory facilities and learning about research at the Laboratory.
- 19 - Commander Philip Arthur White, MBE, Royal Navy, presently with the University of Hawaii, met with Mr. Otsu to discuss a research proposal he is preparing for Dr. John Craven, University of Hawaii.
- 19-20 - Mr. Barry V. Lanier, Fishery Consultant, San Diego, visited Mr. Otsu and Mr. Hida. Mr. Lanier was interested in obtaining general information on the local fishery situation. On subsequent days he met with several other members of the staff.
- 25 - Dr. Arthur Niimi, University of Guelph, Ontario, Canada. Dr. Niimi will be joining the staff of Environment Canada (formerly Fisheries Research Board of Canada) on November 1.

La Jolla Laboratory

- October 5 - Dr. Robert A. Skillman, SWFC, Honolulu Laboratory.
- 12 - Mr. Bruce L. Wing, NMFS Northwest and Alaska Fisheries Center, Auke Bay Laboratory, Auke Bay, Alaska.

- October 12 - Dr. B. Breton, INRA, Jouy-en-Josas, France.
- 18 - Mr. J. Gordon Vaeth, National Environmental Satellite Center, Washington, D.C. to discuss use of blimps in fisheries surveys with Director Barrett.
- 20 - Mr. Sidney Marcus, NOAA, National Oceanographic Data Center, Washington, D.C.
- 17-20 - Dr. Douglas R. McLain, NMFS Pacific Environmental Group, Monterey, California.
- 26 - Mr. Gordon D. Shadoan, NMFS Northwest Administrative Service Office, Seattle, Washington.
- October 27 -
- November 3 - Dr. Lamarr Trott, Chief, Fisheries Assessment Division and Mr. Andrew Vrooman, NMFS, Washington, D.C.

Pacific Environmental Group

- October 18 - Mr. Laurence Arnold, EDS, NODC, Washington, D.C.
- 25-26 - Dr. Sus Tabata, Environmental Canada, Victoria, B.C.
- 31 - Dr. Curt Collins, National Science Foundation, Washington, D.C.

Tiburon Laboratory

- October 2 - David Choquette, Seafood Divers of Alaska, Juneau, Alaska
- David Dart, Seafood Divers of Alaska, Juneau, Alaska.
- 6 - Chris Dewees, UC-Sea Grant, UC, Davis, California
- 12 - Don Wienau, Arguay Apparel Co., San Francisco, California
- 17 - Herb Sanborn, NMFS, Seattle, Washington
- John W. Tucker, North Carolina State University, Raleigh, North Carolina
- 19 - John Diffenderfer, Baytronics Corp., Oakland, California.
- D.L. Abbott, Konel Corp., So. San Francisco, California
- J.L. Burkhill, Konel Corp., So. San Francisco, California

- October 21 - F.T. Weiss, Shell Development Co., Houston, Texas
- 25 - Dave Grant, S.F. Seamaster, San Francisco, California
- 27 - R. Chris Fee, NOAA, Terminal Island, California
- Hitoshi Kito, Tokohu, Regional Fish. Res. Lab.,
Shiogama, Miyagi, Japan.

TRAINING

- October 11-12 - Maureen Woods, Librarian, Tiburon Laboratory, Data
Base Seminar, Data Courier, San Francisco, California.
- 14 - An EEO Seminar, "171 Workshop" was presented by Ms.
Betteann Myers of the Civil Service Commission at the
SWFC. The purpose of the seminar was to acquaint super-
visors and employees with the significant features of
the Personal Qualification Statement (SF-171). All
employees of the Center were encouraged to attend.

PERSONNEL ACTIONS

- October 2 - Thomas Duffy, Stephen Stangl, Dale Powers, Jim
Lambert, Charles Peters: All Biological Technicians,
entered on temporary appointments - La Jolla Laboratory.
- 3 - Tom Shay, Biological Technician, Appointment - La Jolla
Laboratory.
- 7 - Robert Rankin, Computer Programmer - Resignation -
La Jolla Laboratory.
- 9 - John Everett, Leader of the Porpoise/Tuna Interaction
program, transferred to NMFS, Washington.
- Charles Evans, Biological Technician - Appointment
(part time) - La Jolla Laboratory.
- October 9 - Nancy Wiley, Computer Specialist - Promotion - Tiburon
Laboratory.
- Alicia K. Rhodes, Clerk-Stenographer - Promotion -
Tiburon Laboratory.
- 11 - Ken Wallace, Biological Technician - Appointment -
La Jolla Laboratory.

October 25 - John Young, Biological Technician - Appointment - La Jolla Laboratory

28 - Joan Roff, Library Aid - Resignation - La Jolla Laboratory.

UNITED STATES
DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
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